

11-24-00

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Case Docket No. PHN 17,778

THE COMMISSIONER FOR PATENTS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor(s):  
 INGRID JOZEF MARIA SNIJKERS-HENDRICKX,  
 HENRICUS ALBERTUS MARIA VAN HAL, VOLKER DIRK HILDENBRAND

For: LOW-PRESSURE MERCURY VAPOR DISCHARGE LAMP

**ENCLOSED ARE:**

- [X] Appointment of Associates;  
 [X] Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;  
 [X] Preliminary Amendment;  
 [X] Specification (6 Pages of Specification, Claims, & Abstract);  
 [X] Declaration and Power of Attorney:  
     (2 Pages of a [ ] fully executed [X] unsigned Declaration);  
 [X] Drawing (1 sheet of [ ] informal [X] formal sheets);  
 [X] Certified copy of a EUROPEAN application Serial No.99204038.6;  
 [X] Authorization Pursuant to 37 CFR §1.136(a)(3)  
 [ ] Other:  
 [ ] Assignment to

**FEE COMPUTATION**

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - \$710.00
Total Claims	3 - 20 =	0	X \$18 =	0.00
Independent Claims	1 - 3 =	0	X \$80 =	0.00
Multiple Dependent Claims, if any			\$270 =	0.00
TOTAL FILING FEE . . . . .			=	\$710.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

[ ] Amend the specification by inserting before the first line as a centered heading --Cross Reference to Related Applications--; and insert below that as a new paragraph --This is a continuation-in-part of application Serial No. , filed , which is herein incorporated by reference--.

**CERTIFICATE OF EXPRESS MAILING**

Express Mail Mailing Label No. ET 458218634US  
 Date of Deposit November 22, 2000  
 I hereby certify that this paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Natale A. Manzo  
 Typed Name

Signature

*Dicran Halajian*  
 Dicran Halajian, Reg. 39,703  
 Attorney  
 (914) 333-9607  
 U.S. Philips Corporation  
 580 White Plains Road  
 Tarrytown, New York 10591

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 09/18/00  
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10912 U.S. PRO

09718258-112200

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

INGRID J.M. SNIJKERS-HENDRICKX ET AL.

PHN 17,778

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Examiner:

Title: LOW-PRESSURE MERCURY VAPOR DISCHARGE LAMP

Commissioner for Patents  
Washington, D.C. 20231

10003 U.S. PRO  
09/18/58  
11/22/00

AUTHORIZATION PURSUANT TO 37 CFR §1.136(a)(3)  
AND TO CHARGE DEPOSIT ACCOUNT

Sir:

The Commissioner is hereby requested and authorized to treat any concurrent or future reply in this application requiring a petition for extension of time for its timely submission, as incorporating a petition for extension of time for the appropriate length of time.

Please charge any additional fees which may now or in the future be required in this application, including extension of time fees, but excluding the issue fee unless explicitly requested to do so, and credit any overpayment, to Deposit Account No. 14-1270.

Respectfully submitted,

By Dan Halajian  
Dicran Halajian, Reg. 39,703  
Attorney  
(914) 333-9607

IN THE UNITED STATE PATENT TRADEMARK OFFICE

IN re APPLICATION OF

ATTY. DOCKET

INGRID J.M. SNIJKERS-HENDRICKX ET AL.

PHN 17,778

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Examiner:

Title: LOW-PRESSURE MERCURY VAPOR DISCHARGE LAMP

Commissioner for Patents  
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and examination,  
please amend the above-identified application as follow:

IN THE CLAIMS

Please amend the claims as follows:

Claim 3, line 1, delete "or 2"

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REMARKS

The claim has been amended to delete multiple dependencies.

The within amendment is limited to the equivalent of cancellation of claims, and pursuant to MPEP §506, should be entered prior to calculation of the fee.

Respectfully submitted,

By

  
Dicran Halajian, Reg. 39,703  
(914) 333-9607  
November 19, 2000

09718258-112200

## Low-pressure mercury vapor discharge lamp

The invention relates to a low-pressure mercury vapor discharge lamp comprising:

a discharge vessel which is closed in a gastight manner and which encloses a discharge space, which discharge vessel has a wall of glass containing alkali ions with an inner surface;

a filling, which comprises an inert gas and mercury, in the discharge vessel, and

means for maintaining an electric discharge in the discharge vessel, the inner surface of the discharge vessel having a coating which counteracts transport of mercury from the filling to the wall of the discharge vessel and of alkali ions from the wall of the discharge vessel to the filling.

Such a low-pressure mercury vapor discharge lamp is known from US-A-5,753,999.

To preserve the efficiency of the low-pressure mercury vapor discharge lamp, it is important that the extraction of mercury from the filling of the lamp is counteracted. Without special measures, mercury ions can be absorbed in the wall of the discharge vessel where they can be reduced to metallic mercury. The resultant blackening blocks radiation generated by the lamp, thereby reducing the efficiency of the lamp. In addition, the mercury pressure in the lamp decreases, which also adversely affects the efficiency. Also migration of alkali ions from the wall to the filling leads to a reduction of the efficiency of the lamp since amalgam is formed and the mercury pressure decreases. The decreasing mercury pressure also leads to a reduction of the service life of the lamp.

For reasons relating to the cost price of the lamp and protection of the environment, preferably, the consequences of the extraction of mercury from the discharge are not counteracted by providing the lamp with an excess of mercury.

In the known lamp, a layer of  $\text{SiO}_2$  is applied directly to the wall of the discharge vessel, which layer counteracts the migration of alkali ions. At the surface of said

layer facing the discharge space, the lamp is provided with a powder coating of an oxide, such as yttrium oxide. This layer impedes the transport of mercury to the wall of the discharge vessel. To this end, the powder of the layer must have a grain size below 1  $\mu\text{m}$ .

- 5 It is a drawback of the known lamp that, in order to counteract interaction of mercury from the filling with the wall and with components from the wall of the discharge vessel, a coating consisting of two layers must be provided on the wall. This makes the manufacture of the lamp more difficult.

- 10 It is an object of the invention to provide a low-pressure mercury vapor discharge lamp of the type described in the opening paragraph, wherein, despite the simple structure of the lamp, the loss of mercury from the filling due to interaction with the wall and with constituents thereof is effectively counteracted.

- 15 In accordance with the invention, this object is achieved in that the inner surface is coated with a film which comprises at least a compound selected from the group formed by trifluorides and oxyfluorides of an at most trivalent element selected from lanthanides, lanthanum, scandium and yttrium.

- 20 The film effectively counteracts the transport of both mercury ions to the wall and alkali ions to the filling. As a result, an important cause of the decrease in efficiency of the lamp with increasing burning hours is counteracted. The fact is that the trifluorides and oxyfluorides of the above-mentioned trivalent metals are not ion conducting. Cerium and terbium, which belong to the lanthanides, which include elements having atomic number 58 through 71, are not only trivalent but also tetravalent. In order to exclude the presence of tetravalent cerium and terbium compounds, which are ion conducting, the use of cerium and  
25 terbium is excluded.

- The film can be readily provided by applying a solution of a fluorine-containing compound, or of a fluorine and oxygen-containing compound, of the selected metal to the inner surface of the wall of the discharge vessel, removing the solvent and heating the compound to decompose it into the trifluoride and/or oxyfluoride of the  
30 metal. For this purpose, it is favorable to use low-molecular organic acid residues, such as trifluoroacetate.

In a special embodiment of the lamp in accordance with the invention, the wall is provided, on a side of the film facing the discharge space, with a coating comprising a luminescent material. This film has the advantage that it is resistant to water and anionic

surface-active substances, so that the luminescent material can be provided as an aqueous suspension. Customary volatile organic dispersion agents, such as butylacetate, can thus be avoided.

It is favorable if the film comprises yttrium fluoride and/or

- 5 yttrium oxyfluoride. Yttrium is cheaper than most lanthanides and it has already been used in low-pressure mercury vapor discharge lamps as a mercury barrier and, doped with europium as a luminescent material.

- 10 For the luminescent material, the lamp may comprise a substance which emits radiation in a wide band of the visible spectrum. On the other hand, two or more substances, mixed or not, may be present which each emit in a different yet complementary part of the visible spectrum, for example in the red and the green part, or in the red, the green and the blue part. UV radiation generated by the discharge is converted by the materials to visible radiation. The film on the inner surface of the wall of the discharge vessel does not have this effect.

- 15 The means for maintaining an electric discharge may consist of an electrode pair in the discharge vessel. They may alternatively consist of an electrode in the discharge vessel and an electrode on the outside, near the discharge vessel or in contact with the discharge vessel. On the other hand, these means may comprise an electric coil, which is situated outside the discharge space, for example in a recessed portion of the discharge  
20 vessel, so that the discharge surrounds the coil.

The discharge vessel may have various shapes and dimensions. For example, the discharge vessel may be a linear tube or a curved tube. It may be composed of various straight tubular portions, which are connected in series. On the other hand, the discharge vessel may be, for example, spherical or oval or pear-shaped.

- 25 The lamp can suitably be exposed to high loads, for example  $500 \text{ W/m}^2$  or higher.

- 30 The drawing shows a side view, partly cut away, of an embodiment of the low-pressure mercury vapor discharge lamp in accordance with the invention.

In the drawing, the low-pressure mercury vapor discharge lamp comprises a gastight discharge vessel 1 which encloses a discharge space 2 and which includes a wall 3 of

glass containing alkali ions with an inner surface 4. The discharge vessel 1 contains a filling which comprises an inert gas and mercury. The lamp has means 5, in the drawing an electrode pair, for maintaining an electric discharge in the discharge vessel 1, in the lamp shown, an electrode pair in the discharge vessel 1. The inner surface 4 of the discharge vessel 1 has a coating which serves to counteract transport of mercury from the filling to the wall 3 of the discharge vessel 1 and of alkali ions from the wall 3 of the discharge vessel 1 to the filling.

For this purpose, the inner surface 4 is coated with a film 6 which at least comprises a compound selected from the group formed by trifluorides and oxyfluorides of an at most trivalent element selected from lanthanides, lanthanum, scandium and yttrium.

In the case of the lamp shown, the wall 3 is provided, on a side of the film 6 facing the discharge space 2, with a coating 7 comprising luminescent material:  $Y_2O_3$  activated with  $Eu^{III}$  (YOX), cerium-magnesium-aluminate activated with Tb (CAT) and barium-magnesium-aluminate activated with  $Eu^{II}$  (BAM).

The film 6 at least comprises a compound selected from yttrium oxyfluoride and yttrium fluoride; in the selected lamp use is made of a combination of these substances.

The film was obtained by applying a solution of 1.25 g yttrium trifluoroacetate in 100 ml water, driving out the solvent and heating the discharge vessel, for example for 5 minutes, to, for example, 500 °C. On the other hand, also solutions in other solvents, such as ethanol, and more concentrated or less diluted solutions, such as 0.5 to 5% by weight solutions, for example 1 to 3% by weight solutions, can be used. Luminescent material was applied by providing a suspension of YOX, CAT and BAM in water and subsequently drying it. The luminescent material was sintered, whereafter the discharge vessel was evacuated, provided with mercury and an inert gas and sealed in a vacuumtight manner. Heating the film may coincide with sintering the luminescent material. The resultant film had a thickness of approximately 10 nm. However, the thickness of the film may also be chosen to be larger or smaller, for example at least approximately 1 nm to approximately 50 nm. If the films are thinner, there is a risk that the film is not closed, while thicker films only require additional material.



## CLAIMS:

1. A low-pressure mercury vapor discharge lamp comprising:  
a discharge vessel (1) which is closed in a gastight manner and which encloses  
a discharge space (2), which discharge vessel has a wall (3) of glass containing alkali ions  
with an inner surface (4);  
5 a filling, which comprises an inert gas and mercury, in the discharge vessel  
(1), and  
means (5) for maintaining an electric discharge in the discharge vessel (1),  
the inner surface (4) of the discharge vessel (1) having a coating which counteracts transport  
of mercury from the filling to the wall (3) of the discharge vessel (1) and of alkali ions from  
10 the wall (3) of the discharge vessel (1) to the filling,  
characterized in that the inner surface (4) is coated with a film (6) which  
comprises at least a compound selected from the group formed by trifluorides and  
oxyfluorides of an at most trivalent element selected from lanthanides, lanthanum, scandium  
and yttrium.  
15
2. A low-pressure mercury vapor discharge lamp as claimed in claim 1,  
characterized in that the wall (3) is provided, on a side of the film (6) facing the discharge  
space (2), with a coating (7) comprising a luminescent material.
- 20 3. A low-pressure mercury vapor discharge lamp as claimed in claim 1 or 2,  
characterized in that the film (6) comprises at least a compound selected from  
yttriumoxyfluoride and yttriumtrifluoride.

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## ABSTRACT:

The low-pressure mercury vapor discharge lamp has a filling of mercury and an inert gas, and the glass discharge vessel (1) is provided on the inner surface (4) of the wall (3) with a film (6) of trifluoride and/or oxyfluoride of at least one element, which is trivalent at most, which is selected from lanthanides, lanthanum, scandium and yttrium. The film (6) counteracts transport of mercury from the discharge vessel to the wall (3) and of alkali from the wall (3) to the discharge vessel. In this manner, a decrease of the lamp's efficiency (?) and of the service life are counteracted.

Sole Figure



# DECLARATION and POWER OF ATTORNEY

ATTORNEY'S DOCKET NO.:  
**PHN 17.778 US**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**"Low-pressure mercury vapor discharge lamp"**

the specification of which (check one)

☐ is attached hereto.

☐ was filed on \_\_\_\_\_ as Application Serial No. \_\_\_\_\_ and was amended on \_\_\_\_\_ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

## PRIOR FOREIGN APPLICATION(S)

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	99204038.6	30 Novmeber 1999	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

## PRIOR UNITED STATES APPLICATION(S)

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statements may jeopardize the validity of the application or any patent issued thereon.

**POWER OF ATTORNEY:** As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Jack E. Haken, Reg. No. 26,902  
Michael E. Marlon, Reg. No. 32,266  
Edward M. Blocker, Reg. No. 30,245

SEND CORRESPONDENCE TO: Corporate Patent Counsel;  
U.S. Philips Corporation;  
580 white Plains Road; Tarrytown, NY 10591

DIRECT TELEPHONE CALLS TO:  
(name and telephone No.)  
(914) 332-0222

Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name <b>SNJKERS-HENDRIXKX</b>	First Name <b>Ingrid</b>	Middle Name <b>Jozef Maria</b>
Residence & Citizenship	City <b>Eindhoven</b>	State of Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State of Country <b>The Netherlands</b>
Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name <b>VAN HAL</b>	First Name <b>Henricus</b>	Middle Name <b>Albertus Maria</b>
Residence & Citizenship	City <b>Eindhoven</b>	State of Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State of Country <b>The Netherlands</b>
			Zip Code

Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name <b>HILDENBRAND</b>	First Name <b>Volker</b>	Middle Name <b>Dirk</b>
Residence & Citizenship	City <b>Eindhoven</b>	State of Foreign Country <b>The Netherlands</b>	Country of Citizenship <b>The Netherlands</b>
Post Office Address	Street <b>Prof. Holstlaan 6</b>	City <b>5656 AA Eindhoven</b>	State of Country <b>The Netherlands</b> Zip Code
Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name	First Name	Middle Name
Residence & Citizenship	City	State of Foreign Country	Country of Citizenship
Post Office Address	Street	City	State of Country Zip Code
Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name	First Name	Middle Name
Residence & Citizenship	City	State of Foreign Country	Country of Citizenship
Post Office Address	Street	City	State of Country Zip Code
Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name	First Name	Middle Name
Residence & Citizenship	City	State of Foreign Country	Country of Citizenship
Post Office Address	Street	City	State of Country Zip Code
Dated:		Inventor's Signature:	
Full Name of in Inventor	Last Name	First Name	Middle Name
Residence & Citizenship	City	State of Foreign Country	Country of Citizenship
Post Office Address	Street	City	State of Country Zip Code